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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/654,501	09/01/2000	Yuji Takahashi	PM 273792	7004

7590 05/25/2004

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EXAMINER	
BAUMEISTER, BRADLEY W	
ART UNIT	**PAPER NUMBER**
2815	

DATE MAILED: 05/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/654,501	TAKAHASHI ET AL.	
	Examiner	Art Unit	
	B. William Baumeister	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,6-13,16-22,25-28,30-34,38-46 and 49-62* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6-13,16-22,25-28,30-34,38-46 and 49-62* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152).
6) ☐ Other: _____.

DETAILED ACTION[1]

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 49 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 49 depends from claim 1. Claim 1 sets forth "a secondary light source comprising a fluorescent material... and a sealing member...being disposed above said secondary light source..." Depending claim 49 alternatively sets forth, "wherein said fluorescent material is disposed above said sealing member..." It is not reasonably clear how the secondary light source (or fluorescent-material containing resin) could be simultaneously disposed above and below the sealing member as required by claim 49.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

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[1]Much of the present Office action is copied from the previous action (paper #23). The primary issues raised by the present amendment are addressed in boldface type for clarity.

4. Claims 1-3, 6-10, 21, 22, 26-28, 30-34, 38, 40-42, 59, 61 and 62 are rejected under 35 U.S.C. 103(a) as obvious over Soules '254 in view of Butterworth '507, Tsutsui '536 and Nakamura et al. '558.

a. Soules discloses LEDs or laser diodes that emit primary, blue light in the range of 420-470 nm (col. 3, lines 57-60). The LED is covered with a phosphor-containing polymer layer 15 and clear polymer lens 16 (e.g., FIG. 2), and both of these materials may be composed of the same material such as silicone (col. 3, lines 50-56). Various phosphors are employed so that a portion of the blue light emitted from the semiconductor device is absorbed and the phosphors emit secondary, green and red light respectively, so that the primary and secondary colors are blended to produce various colors including white light.

i. Regarding claims 8 and 32, since polymer layer 15 contains the phosphors and polymer layer 16 is composed of the same material as layer 15, but does not possess phosphors, the structure reads on a polymer layer having a step-graded phosphor profile.

ii. Soules also discloses that the phosphor layer 15 is covered with a bullet-shaped sealing member 16 which are both composed of the same material, as set forth in various claims such as claims 6, 7 and 9, but does not appear to mention the presence of conventional structures such as a lead frame having a cup-shaped portion. Also, while Soules sets forth that various fluorescent materials may be employed, it does not teach that any of the phosphors listed in claim 1 or 42 may be specifically employed.

b. Butterworth discloses UV/blue LEDs disposed in a cup-shaped reflector/lead frame (or box, claim 42) and which are overcoated with any of various bullet-shaped, fluorescent-dye-containing epoxies 240. One phosphor listed is the green-emitting ZnS:Cu,Al,Au (col. 3, line 54), as set forth in claims 1 and 42. Butterworth also states that depending on the implementation, some unabsorbed original blue light may also pass through the lens that focuses light (col. 2, lines 64, 65) and states that multiple dyes can be employed to produce white (or mixed) light (i.e., also use a red dye) (col. 3, line 5). Thus, it would have been obvious to one or ordinary skill in the art at the time of the invention to dispose the device taught by Soules on a cup-shaped portion of a lead frame as taught by Butterworth for the purpose of providing a receptacle for supporting the chip and the polymer and/or for increasing the light emission efficiency by reflecting laterally-directed light upward. It would have further been obvious to one of ordinary skill in the art at the time of the invention to have employed ZnS:Cu,Al,Au as taught by Butterworth as a fluorescent material for any of various reasons such as: (1) to obtain the particular hue associated with the specific phosphor or (2) for business reasons such as relating to the cost and availability of a particular phosphor.

c. Butterworth further teaches (see e.g., prior-art FIG 1) that it was also known to alternatively provide the fluorescent-material-containing resin such that it is contained in the cup portion with the transparent resin sealing member formed thereabove. It would have been obvious to have employed the resin configuration of either one of Butterworth's FIG 1 as well as that of the FIG 2 embodiments because

Butterworth teaches that the FIG 1 embodiment was a more conventional alternative to the FIG 2 embodiment.

d. Claims 1 and 21 have been previously amended to set forth that the primary light source includes a GaN LED and includes a single reflective layer disposed on a surface of a substrate on which no light-emitter layer is formed (e.g., on the rear side of the substrate). **Newly added claims 59-62 recited that the reflective layer is directly disposed on said surface of said substrate and said surface is opposite to a side wherein said light emitting layer is located.** Dependent claims 38-40 further set forth that the GaN emitter is formed on a sapphire substrate. Soules does not disclose the specific structural composition of the LED/LD that may be used nor the substrate on which the GaN emitter may be formed.

i. Tsutsui '536 discloses GaN emitters formed on sapphire substrates (e.g., col. 1) and teaches in the second embodiment (e.g., FIG 6) that the GaN chip may further possess a light reflection film 11 **directly on the rear side of the sapphire substrate 1a, opposite to a side wherein said light-emitting layer is located** for reflecting light that is directed towards the substrate back towards the front, upper light emission surface (col. 7).

ii. It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the GaN emitter of Soules on a sapphire substrate because this is the most conventionally employed substrates for growing GaN structures, as evidenced by Tsutsui. It would have further been obvious to one of ordinary skill in the art at the time of the invention to have further included a

substrate rear-side reflector layer in the Soules light emitter for the purpose of increasing light extraction from the front surface as taught by Tsutsui.

e. The independent claims, such as claims 1 and 21, have been amended to further set forth that a transparent electrode is disposed above the single reflective layer. Regardless of whether any of Soules, Butterworth and Tsutsui discloses this feature, Nakamura '558 does teach this limitation. Specifically, Nakamura teaches GaN-based LEDs formed on various substrates such as sapphire (e.g., col. 20, line 41) wherein a "light-transmitting electrode" (e.g., element 15) is formed above the p-side semiconductor layer(s)--and therefore above the reflective layer--for the purpose of improving ohmic contact and increasing the current spreading across the p-side layer (see e.g., Summary of Invention). Nakamura states that "light transmitting" means at least 1%--but usually 20 to 40%--of light emitted from the semiconductor emitter is transmitted therethrough, and does not necessarily mean colorless, transparent; col. 4, lines 57-64. Restated, the electrode may be either transparent, or partially transparent. Moreover, the present claims do not set forth any objective values for what percentage of light transmission constitutes "transparent." As such, layer 15 reads on the limitations regardless of whether the material specifically employed is fully transparent or partially transparent.

i. It would have been obvious to one of ordinary skill in the art at the time of the invention to have further employed within the emitters of Soules/Butterworth/Tsutsui a transparent p-side electrode for either of the

purposes of increasing ohmic contact and improving the current spreading through the p-type semiconductor layer(s) as taught by Nakamura.

5. Claims 11-13, 16-20, 39 and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura '558 as applied to the claims above, and further in view of Hampden-Smith et al. '123. Soules discloses various phosphors that may be used for green and red photoluminescence, but does not appear to disclose any of the specific phosphors recited in the Markush group of claim 11 (ZnS:Eu and Y2O2S:Ce).

a. Hampden-Smith '123 teaches various sulfur-containing phosphors that can be used in an array of applications including photoluminescence (col. 35, lines 28-33). These phosphors include ZnS:Eu (paragraph spanning cols. 35-36); ZnS:Cu (Table 1, col. 37) and ZnS:Cu, Au, Al (col. 36, lines 8-15) for various hues of blue/green and CaS:Eu for red light (col. 36, line 19). It would have been obvious to one of ordinary skill in the art at the time of the invention to employ within the light emitter of Soules/Butterworth/Tsutsui/Nakamura, any of the phosphors specifically mentioned in Hampden-Smith for any of various reasons such as: (1) to obtain the particular hue associated with the specific phosphor or (2) for business reasons such as relating to the cost and availability of a particular phosphor.

6. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura as applied to the claims above, and further in view of Thompson et al. '489 (previously made of record).

a. The cited prior art teaches blue-emitting semiconductor LEDs overcoated with downconverter phosphors as explained above, but does not disclose the device used in combination with an additional red LED.

b. Thompson teaches a full-color LED assembly comprising two LEDs and a photoluminescent downconverter phosphor disposed for re-emission of longer wavelength light in response to light that is emitted from only one of the two LEDs. The phosphor may either emit green or red light. The LED that is not in communication with the downconverter phosphor may emit red light. Through the use of the combination of an LED with a phosphor and an LED without a phosphor, different colors of light can be selectively obtained subsequent to manufacturing.

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have employed a blue LED overcoated with a green-emitting phosphor as taught by Soules/Butterworth/Tsutsui/Nakamura as explained above in combination with a red LED instead of an additional red phosphor for the purpose of obtaining white light emission while simultaneously enabling increased post-manufacturing color control beyond that enabled by a blue LED overcoated with green and red phosphors at least for any of the purposes of (1) providing an assembly that can selectively emit various desired colors (e.g., red, blue and green, or white); (2) enabling later color readjustment in the event that the amount of blue or green light degrades or otherwise changes over time; or (3) providing an assembly wherein the red color is not subject to color alteration attributable to phosphor degradation. Further, it would have been obvious to use a red-emitting LED for the LED which does not produce secondary phosphor re-emission,

since Soules/Butterworth/Tsutsui teach the use of down-converting phosphors (i.e., phosphors wherein higher-energy, shorter wavelength colors are absorbed and re-emitted as lower-energy, longer wavelength colors), and red is the lowest energy, longest wavelength color of blue, green and red, thereby ensuring that regardless of the assembly's configuration or the two LEDs' relative disposition, any spurious light from this second LED will not cause any significant secondary re-emission in the phosphor.

7. Claims 46, 49 and 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura as applied to the claims above (and Hampden-Smith et al. '123 as applied to claim 44/11), and further in view of Komoto et al. '824 (previously made of record).

a. Komoto is directed towards GaN-based light emitters that emit preferably at wavelengths of 380 or shorter and which communicate with fluorescent materials for downconverting the primary light into various colors including white (e.g., col. 3, lines 22-). Komoto's lengthy disclosure and 141 figures include an array of information that is relevant to the present invention. **For example, FIG 41 depicts an embodiment wherein the resin containing a fluorescent material for secondary light emission 142E is contained within the cup of the lead frame. This provides additional evidence beyond Butterworth that it was known to employ the resin configuration set forth in the independent claims.**

b. Regarding claim 46, regardless of whether any of the cited base references further teach that emitters may be arranged in a matrix and have a portion of said matrix being

controlled by a controller, Komoto teaches that the devices may be used in a matrix for various types of displays (e.g., col. 2, lines 25-) including full color displays (e.g. col. 27, lines 1-). A full color display implicates the presence of a controller. It would have been obvious to have employed an emission system as taught by Soules/Butterworth/Tsutsui/Nakamura in a matrix with a controller for the purpose of enabling their use in a full color display as taught by Komoto.

c. Regarding claim 49 (insofar as definite), regardless of whether any of the cited base references further teach that the fluorescent material may be dispersed in a layer that is formed on top of a subjacent light transmittable layer that focuses the light, this is depicted at least in the embodiment of FIG 30C (fluorescent layer 440B is formed on layer 440). It would have been obvious to one of ordinary skill in the art at the time of the invention to have formed the fluorescent layer as an overcoat, as well as in other manners (such as dispersed throughout as in FIG 30A) for the purpose of making the fluorescent layer's emission intensity more uniform as taught by Komoto.

d. Regarding claim 50, regardless of whether any of the cited base references further teach that the device may include two light transmission layers respectively including first and second materials, Komoto discloses variations of an embodiment in Figs 41-46 wherein a dipping layer (e.g., FIG 41, element 142E) includes a fluorescent material, and also discloses variations of an embodiment in FIGs 47-52 wherein a layer of fluorescent material FL is formed on top of the dipping resin layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to have combined these embodiments so as to provide distinct fluorescent materials in each of the dipping layer

and the fluorescent layer for the purpose of increasing the versatility of the manufacturing process be allowing the resultant color of a given batch to be changed to a wider array of colors by only changing or omitting the particular fluorescent material of one of the layers.

8. Claims 43-45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura '558 (and Hampden-Smith for claim 44) as applied to the claims above, and further in view of Shimizu et al. (USP 5,998,925) (previously made of record in the IDS filed by Applicant on 11/8/2001). See e.g., the Fig 12 embodiment providing evidence that it was conventionally known to provide LED groups comprising R,G,B and W LEDs for various conventional lighting purposes.

9. Claims 51-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Soules/Butterworth/Tsutsui/Nakamura (and Hampden-Smith for claims 53 and 54) as applied to the claims above, and further in view of Chiyo et al. '217 (previously made of record by the Examiner in the 892 dated 2/10/2003). Regardless of whether any of the above-cited references expressly, implicitly or inherently disclose that the blue-emitting LED active region may be composed of InGaN MQWs, see e.g., Chiyo col. 2, lines 57-65 teaching that the blue-emitting active region may be composed of GaInN superlattices (or MQWs). It would have been obvious to one of ordinary skill in the art at the time of the invention to have specifically employed GaInN MQWs because this structure was conventionally employed as for active layers of GaN-based LEDs to emit blue light.

Response to Arguments

10. Applicant's arguments with respect to the claims have been considered but are either moot in view of the new ground(s) of rejection or are not persuasive for the reasons set forth hereinabove.

a. Applicant argues that Butterworth teaches away from the present claims because Butterworth is directed towards a lens 240 that contains a dye (FIG. 2). This argument is not persuasive because Butterworth further teaches (see prior-art FIG 1) that it was also previously known to alternatively provide the resin containing the dye 130 within the reflective cup 120, both of which are overcoated with a clear lens 140. As such, the fact that Butterworth states that the FIG 2 embodiment may have advantages over the FIG 1 embodiment does not negate the fact that Butterworth also teaches that the FIG. 1 embodiment was also known and conventionally employed for downconverting LEDs as well.

b. Also see e.g., Lowery et al. USP 6,351,069, FIGs. 1 and 3; Lowery USP 5,959,316, FIGs 2 and 3; Komoto '824 FIG. 41 (cited hereinabove); and Chen USP 5962,971 for further evidence that it was known to provide within the LED's reflector cup, a resin containing a fluorescent material for absorbing at least some of the LED light and re-emitting a second wavelength.

c. Applicant's other arguments are either moot or have been addressed hereinabove.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Lowery 6,351,069.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact Information

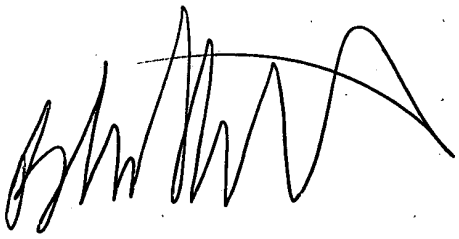
Any inquiry concerning this communication or earlier communications from the examiner should be directed to B. William Baumeister whose telephone number is (571) 272-1722. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (571) 272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

B. William Baumeister
Primary Examiner
Art Unit 2815

May 21, 2004



BRADLEY BAUMEISTER
PRIMARY EXAMINER